VEHICLE WIPER SYSTEM

Project Report by Nikith Y Devadiga

INTRODUCTION

The earliest recorded patents for the windscreen wiper is by George J. Capewell of Hartford Connecticut, which was filed on August 6, 1896. This invention was mainly for an automated, motorised, wiper for "cars, locomotives, buses and such land-vehicles". As the name suggests, windshield wipers remove rain, snow, ice, washer fluid, water, and/or debris from a vehicle's windshield. The majority of motor vehicles, including cars, trucks, buses, train locomotives, and watercraft with cabins—and some aircraft—have at least one such wiper, which is usually a legal requirement. Modern wiper systems use a rain sensor to detect the speed at which raindrops are falling on the windshield. By evaluating the signals from the sensor, a microprocessor determines how fast the wipers should move. Windshield wipers may also run intermittently in modern vehicles. With intermittent wipers, the wipers cycle on and off every couple of seconds instead of continuously running. Intermittent control first appeared in automobiles in the 1970's. Later based on the feature requirements and improvements, automatic wiping system, installing of washer fluids to remove dust from glass pane, rear windshield sensing are added which is now a common feature in all the cars.

OBJECTIVES

The design and implementation is divided into different objectives and outcomes. Below are the list of objectives-

- To turn on the ignition by long pushbutton press
- To vary speeds of LEDs by short pushbutton press
- To turn off ignition by long press and LED to initial position

COMPONENT/ REQUIREMENT ANALYSIS

STM32F407VG

STM32F4DISCOVERY Discovery kit uses the STM32F407 high-performance microcontroller to allow users to develop audio applications easily. It comes with an ST-LINK/V2-A embedded debug tool, one ST-MEMS digital accelerometer, one digital microphone, one audio DAC with integrated class D speaker driver, LEDs, push-buttons, and a USB OTG Micro-AB connector. It is a 32 bit ARM Cortex M4 microcontroller with FPU core, 1-Mbyte Flash memory and 192-Kbyte RAM in an LQFP100 package. For our application, User pushbutton connected to PA0 pin and three inbuilt LEDs orange, green, blue LEDs are used.

Push button

A push button switch consists of a small, sealed mechanism that completes an electric circuit when pressed. During operation, a small metal spring inside makes contact with two wires, allowing electricity to flow. A spring retracts when it's off, causing contact to be interrupted, which will prevent current from flowing.

STM32 IDE

It is a popular and efficient platform for integrated development of STM32 based products. It consists of Eclipse and GCC based IDE which is free of cost and better to handle. It supports almost all ARM processors for programming.

Qemu

Qemu is a free, open source emulator. Dynamic binary translation emulates the machine's processor and provides a set of different hardware and device models for the machine, allowing it to run a variety of guest

operating systems. For our requirement, STM32F407 Discovery board is emulated with accessibility limited to User pushbutton and LEDs.

RESEARCH ON WIPER SYSTEM

BMW

Turn on the ignition initially. Since most of the cars have keyless entry, no need of manual key insertion required

In most of the BMW cars, arrow button will start the wiping operation. It should be observed that initial position is preset and rests in this preset position one wiper is turned off. Normal wiping mode includes pressing the button only once while the Fast wiping mode is entered when the button is pressed twice. If the model is not equipped with rain sensor, then Intermittent Wipe mode is activated where wiping action takes place at irregular intervals. If equipped with rain sensor, the wiping duration per cycle is controlled by the rain sensor mounted on the windshield infront of the rear view mirror. If there is a danger that the washer fluid will freeze on the windshield, do not use the washers. Otherwise, one may have difficulty seeing. These systems utilize an LED sensor, fitted between the windshield and rear view mirror, to detect the amount of rain or snow falling on the windshield. There are a number of infrared light-emitting diodes (LEDs) and a central photodiode which make up the “rain sense” portion of the system. In modern BMW cars, Autobutton is pressed to turn on rain sensor sensitivity change provision "+" indicating increase and "-" indicating decrease in sensitivity. Pulling down wiper lever will turn on rear wipers. If in reverse mode, rear wipers are activated.

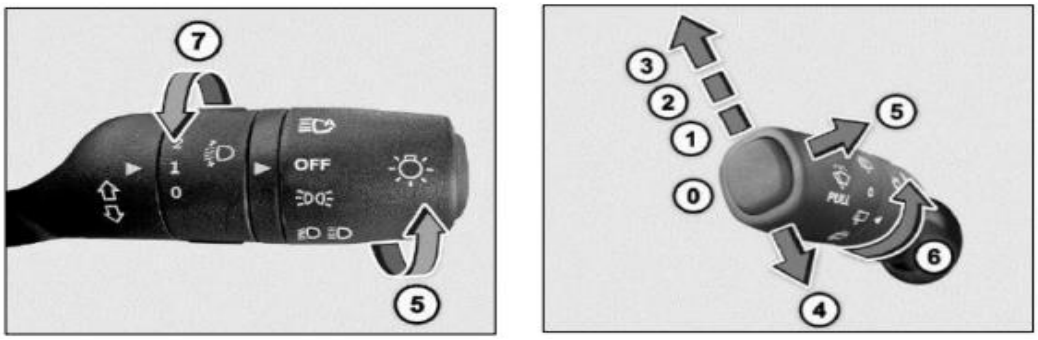
Audi

By reflecting the LED light onto the photo sensor, the windshield reflects the invisible light that is emitted by the LEDs.By reflecting the LED light onto the photo sensor, the windshield reflects the invisible light that is emitted by the LEDs.Afterward, this information is relayed to a computer control unit, which adjusts the intermittent wiper delay intervals accordingly. The wiper system is very reliable, any kind of dust particles will never affect the overall sensing and wiping operation. Press the stalk down one to wipe only once. Press and hold the stalk down for continuous wiping operation. Hold down for few seconds the speed of the wipers increase. Stalk is moved one up from off position to start the automatic rain sensing wiping. From MMI screen, select vehicle, light and visibility, turn off rain sensor. Stalk position up for continuous low speed wiping. Hold the stalk toward the driver to wash windshield, once released, it will wipe three more time. For rear wiper operation, press the button on end of the stalk.

Tata wiper system (Harrier)

Initial OFF position, the switch rotating situated at left is used to implement intermittent wiper action. To enable this stalk is moved up from its initial position Total five sensitivity options are available. Further pushing upwards the stalk implements Slow wipe operation for continuous slow wipe. The topmost upper position is used for Fast wipe operation. The stalk is pulled down and held for slow operation and the wiper will be running continuously untill stalk is released. For windshield washing, pull the stalk downwards, fluid will be released, the wipers operate for nearly three more

seconds and 1 extra cycle after 5 seconds. Auto Mode uses rain and light sensor for wiping action. To activate rear wiping, rotate the knob of the stalk clockwise. If the knob is rotated counter clockwise, the wiping arm aligns to its position.

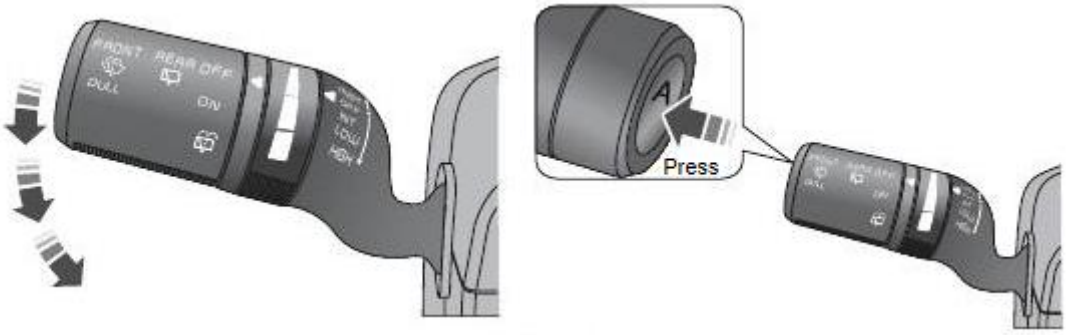


Kia

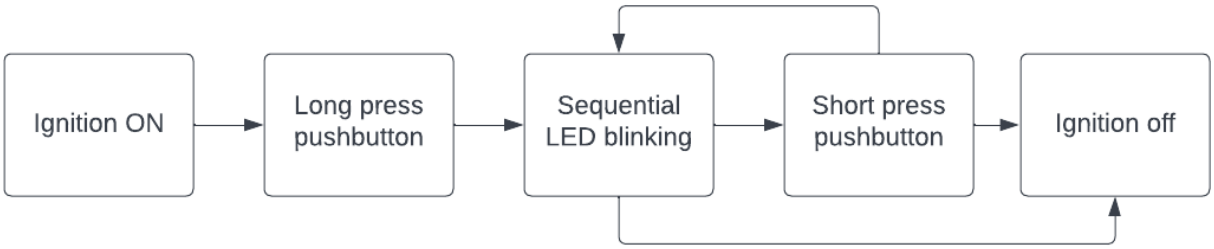
Rain sensor is placed on the upper end of windshield glass senses the quantity of rainfall and controls the frequency of wiping for a standard interval of time. There will be a marking indicating the front and rear view windshield wiper operation. Initially turn the ignition on and turn off. There will be 20 seconds duration to utilize wiper service mode. Hold the stalk to Mist mode for at least 3 sec to activate the wipers."-HI/2" is the normal wiper operation,"-L0/1" is the Intermittent operation as seen in the normal cars,"-OFF/0" wiper will be in off state.The lever is pushed away from the driver to eject rear washer fluids to run the wipers 1-3 times approximately until lever is released. If ignition is used and if wiper is in auto mode, automatic check is carried out to check the functionality of the wiper. In auto mode, touching the wiper arm is restricted. Pull the wiper one click down to enter auto mode where the system performs one swipe self check. Pull the lever up one step to perform one swipe, if pressed for long, wiper operates continuously based on the frequency set by the driver.

Mahindra (XUV 500)

For Low Speed Wiping the lever is pushed downwards only once. The lever is pushed down twice from its initial off position to operate wiper in High Speed Wiping mode. The Rain Sensing Operation is automated by turning the ignition on and activate the Auto Wipe Mode if and only if rain senor is equipped which detects the amount of rainfall falling on front windshield.



BLOCK DIAGRAM



WORKING AND METHODOLOGY

Initially, the ignition of the vehicle is turned on. It could key or keyless entry. STM32F407 is the main controller used here. The Discovery board has four inbuilt LEDs out of which three are used. The User Push button, which is a blue pushbutton internally connected to PA0 of STM32 controller is used as the ignition button. A long press of nearly 2 seconds turns on the wiper system. The three positions are namely left, centre and right. Consider the wiping operation starts from right position, it has to move through centre and left and then to original position. Similarly, when button is pressed, sequential operation of three LEDs starts. Three coloured LEDs are green, orange and blue. Further short press of the button, changes the frequency of operation, i.e. blinking time of each LEDs varies which is similar in case of wiping system. Ignition is turned off once the button is long pressed.

RESULTS AND CONCLUSION